A Fundamental Investigation of Threshold Stress in Dispersion-Strengthened Materials

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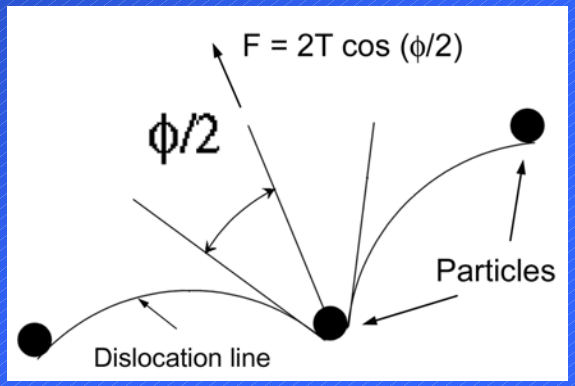
Approach:

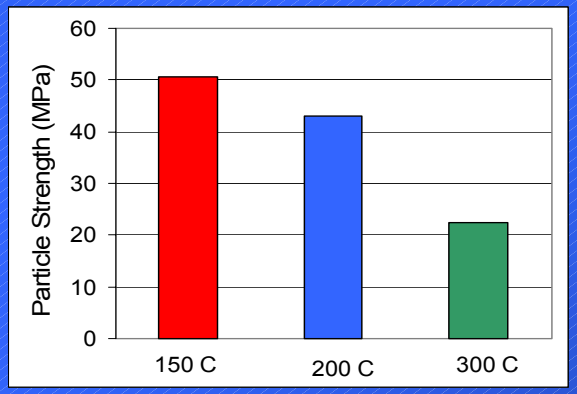
- We are using *in-situ* TEM observation of dislocation-particle interaction at high temperature to study threshold stresses in dispersion strengthened alloys.
- This effort is helping us to develop a model for threshold stress that would explain its temperature dependence for the first time.

Movie clip from *in-situ* TEM at 300 ^{o}C

- Dislocation on a glide plane interacts with Y_2O_3 Particles and overcomes it by climb
- Waiting time between the full bow out and detachment is larger than the time for the motion in-between the particles



Particle strength calculation based on dislocation line tension



Average particle strength measured from detachment angle of dislocation shows temperature dependence

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Education and Outreach:

One graduate student (Sachin Deshmukh) contributed to this work. The results are being used for two undergraduate courses: Met 218 Metals Structure-Property lab and Met 321 Metal Deformation Processes.

Publications:

1. Creep behavior and threshold stress of an extruded Al–6Mg–2Sc–1Zr alloy, *Materials Science and Engineering* A, 381, (2004) 381–385

2. Effect of particle size distribution on strength of precipitation-hardened alloys, *Journal of Materials Research,* (2004) vol. 19, No. 9, 2765-2773

3 Is Transition Based approach better for interpretation of dislocation creep in dispersion strengthened materials?, Creep Deformation: Fundamentals and Applications, edited by R. S. Mishra, J. C. Earthman and S. V. Raj, TMS, p. 219, (2002) Warrendale, PA,USA